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SILVICAL CHARACTERISTICS of PORT-ORFORD-CEDAR

by G. L. HAYES

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by

G. L. Hayes[1/]

Port-Orford-cedar (Chamaecyparis lawsoniana)[2/] is the largest species of its genus and the largest representative of the tribe Cupressineae in North America. It is a highly valued timber tree because of the durability, excellent machinability, light weight, strength, and shock resistance of the wood. It is also valued worldwide as an ornamental.

The natural range of Port-Orford-cedar is restricted, extending only 130 miles along the Pacific Coast from Coos Bay, Oreg., to the Mad River in California (fig. 1). It is abundant only west of the summit of the Coast Range and Siskiyou Mountains, not more than 10 to 40 miles from the coast. But it is scattered farther inland in the Siskiyous, and is found in four isolated locations from Mt. Shasta to the Trinity Mountains in northern California (12).[3/]

Port-Orford-cedar is also known as Port-Orford white-cedar, Lawson false-cypress, Lawson Cypress, and Oregon-cedar.

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[2/] Scientific and common names of trees in this publication follow: Little, Elbert L., Jr. Check list of native and naturalized trees of the United States (including Alaska). U. S. Dept. Agr. Handb. 41, 472 pp. 1953.

[3/] Underscored numbers in parentheses refer to Literature Cited.

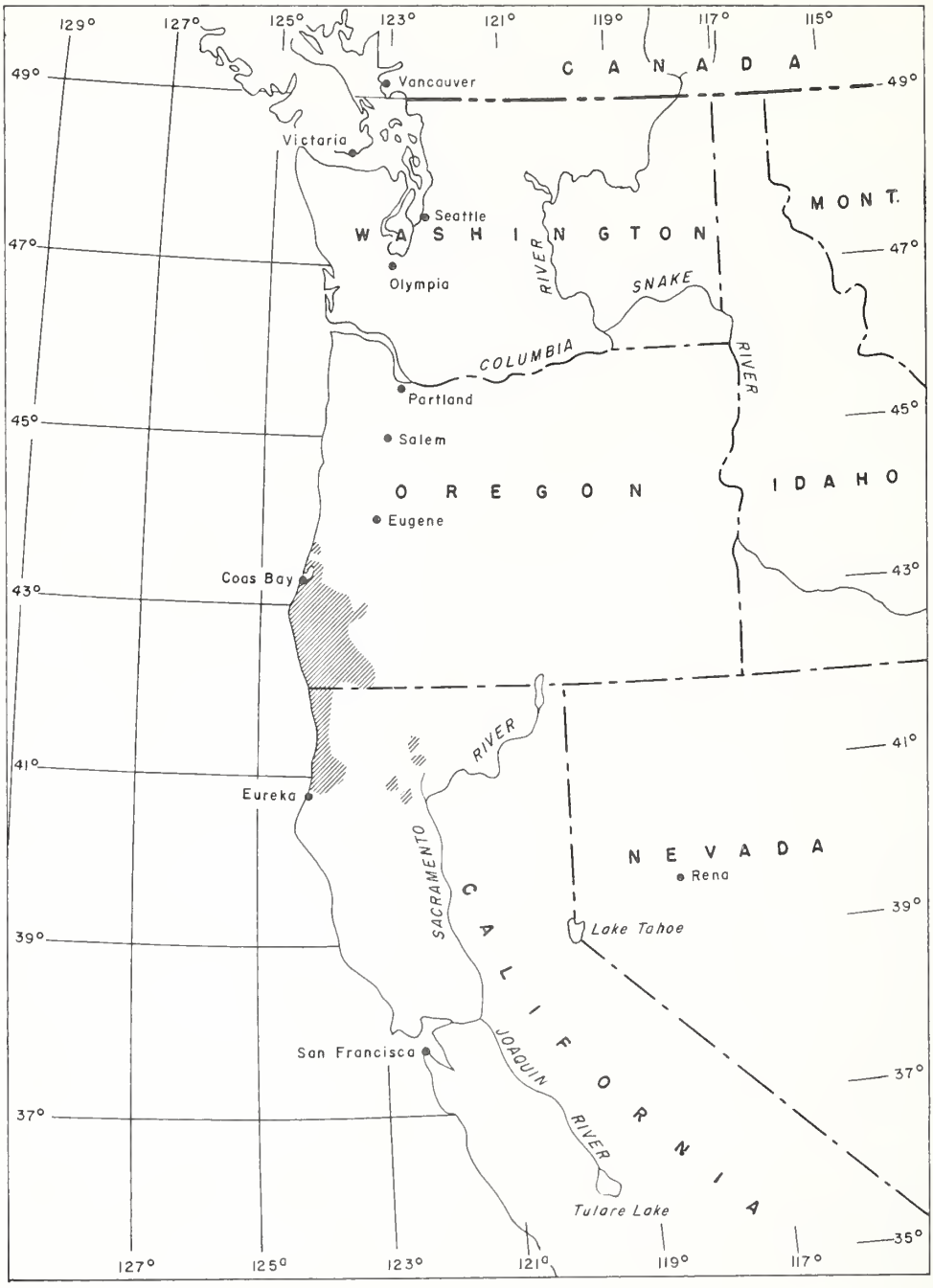

Figure 1.--Range of Port-Orford-cedar.

HABITAT CONDITIONS

Climatic

The climate in the main range of Port-Orford-cedar is characterized by wet winters, dry summers, unusually uniform temperatures, and frequent summer fog. Annual precipitation ranges from 65 or 70 inches along the coast to more than 100 inches on the upper slopes of the Coast Range. About 20 percent of the total falls from April through September. July and August together average less than 1 inch at all stations.

Annual snowfall is only 1 or 2 inches along the coast but exceeds 100 inches in the higher parts of the range. Temperatures average 43° to 46° F. in January and 59° to 64° F. in July. Extremes occasionally exceed 100° F. but have never been recorded below 0° F.

Edaphic

Port-Orford-cedar grows best on deep, moist, well-drained soils, but is not exacting in its soil requirements. Although it is most abundant on medium-textured soils of coastal terraces south of Coos Bay, Port-Orford-cedar makes excellent growth and development on the sandy loams and clay loams of the Coast Range. It also grows in poorly drained, swampy soils and on dry, rocky ridges. It even grows on serpentine soils, which are generally very unfavorable for tree growth.

Physiographic

Port-Orford-cedar grows in all physiographic locations from near sea level to 5,000 feet on the seaward slopes of the Coast Range and Siskiyou Mountains. Inland it is confined to sheltered coves and moist places.

Biotic

Port-Orford-cedar commonly grows in mixtures, scattered through the forest singly or in small groups. However, some nearly pure stands of limited extent are found between Coos Bay and Port Orford, Oreg. (fig. 2). It is a component of four forest types: No. 223, Sitka spruce; No. 229, Pacific Douglas-fir; No. 231, Port-Orford-cedar—Douglas-fir; and No. 243, Ponderosa pine—sugar pine—fir (11).

Figure 2. --A 70-year-old stand of dense, nearly pure Port-Orford-cedar near Port Orford, Oreg.

Typical tree associates are rather difficult to classify because Port-Orford-cedar occupies a unique floristic area. It spans the zone of most rapid transition from the California to the Pacific Northwest floras. In the coastal area, it commonly associates with Douglas-fir (Pseudotsuga menziesii), western hemlock (Tsuga heterophylla), grand fir (Abies grandis), Sitka spruce (Picea sitchensis), lodgepole pine (Pinus contorta), western redcedar (Thuja plicata), and sometimes redwood (Sequoia sempervirens). Inland it is found with western white pine (Pinus monticola), sugar pine (Pinus lambertiana), and incense-cedar (Libocedrus decurrens), and sometimes with ponderosa pine (Pinus ponderosa) and Jeffrey pine (Pinus jeffreyi). Common hardwood associates include tanoak (Lithocarpus densiflorus), Pacific madrone (Arbutus menziesii), golden chinkapin (Castanopsis chrysophylla), red alder (Alnus rubra), Pacific dogwood (Cornus nuttallii), and canyon live oak (Quercus chrysolepis).

Shrubs associated with Port-Orford-cedar are as diverse as its tree associates. The most typical shrubs in the coastal

environment are salal (Gaultheria shallon),[4] box blueberry[5] (Vaccinium ovatum), coast rhododendron (Rhododendron macrophyllum), western thimbleberry (Rubus parviflorus), and Oregongrape (Mahonia aquifolium). In the Siskiyou Uplands and inland, manzanitas (Arctostaphylos spp.), ceanothi (Ceanothus spp.), and shrub forms of canyon live oak, tanoak, and golden chinkapin are common associates.

Unique species associated with Port-Orford-cedar include Brewer spruce (Picea breweriana), Sadler oak (Quercus sadleriana), and Oregon kalmiopsis[6] (Kalmiopsis leachiana).

Port-Orford-cedar is not an aggressive competitor for most sites. It is tolerant enough to live under the canopies of most associates, but it must have overhead light for rapid growth.

LIFE HISTORY

Seeding Habits

Flowering and fruiting.--Flower buds are typically set in the fall, pollination takes place in spring, and fruits mature the following September or October.

Seed production.--Some trees start to bear cones when only 8 years old. Cone bearing becomes general by 20 years, is best at about 100 years (14), but continues for the life of the tree. Seed crops are frequent; heavy crops are borne every 4 or 5 years, and some seed is produced nearly every year. Cones are attacked by a gall midge (Janetiella siskiyou), but damage is generally light.

Seeds of Port-Orford-cedar are not commonly used as food by squirrels. They are eaten, however, in years when cones of other species are scarce. Caged white-footed deer mice showed dislike for the seed (9).

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[4] Scientific and common names of shrubs and herbs in this publication follow: Kelsey, Harlan P., and Dayton, William A. Standardized plant names. Ed. 2, 675 pp. Harrisburg, Pa. 1942.

[5] Commonly called evergreen huckleberry in the Pacific Northwest.

[6] Commonly called Leaches kalmiopsis in the Pacific Northwest.

Seed quality is generally low. Germinative capacity averaged 52 percent (range 0 to 87 percent) in 60 tests (14). Most seed germinates soon after falling, but a small proportion may lie dormant for as long as 5 years before germinating (7).

Seed dissemination.--Seedfall begins in September, reaches a maximum in winter, and continues through the spring and possibly into the summer. This is shown by seed-trap records from Port-Orford-Cedar Experimental Forest, near Powers, Oreg. In 1949-50, seed traps were in place from August 29 to June 14. Of the total seedfall during the period, 7 percent was collected by October 11, 59 percent by January 4, 80 percent by February 16, and 98 percent by May 3. In 1953-54, the traps were in place from September 18 to May 5. The percentages of total seed collected for the period were: December 3, 55 percent; February 1, 95 percent; and May 5, 100 percent. Total seedfall was about 598,000 seeds to the acre in 1949-50, and 1,268,000 to the acre in 1953-54.

Flight distance is probably short for the small-winged seeds of Port-Orford-cedar. Even western redcedar seeds, which are only half as heavy (14) and similar in over-all size, do not carry as far as the seeds of associated species such as Douglas-fir and western hemlock (6).

Vegetative Reproduction

Port-Orford-cedar does not reproduce naturally by sprouts. Cuttings, however, are not difficult to root when appropriate methods are used.

Seedling Development

Establishment.--New seedlings are small and delicate. They probably have little resistance to heat and drouth. However, survival of seedlings is fair. In four spot-seeding tests near Ryderwood, Wash., first-year survival was 47, 21, 72, and 49 percent (9). Although no well-controlled studies have been made that show causes of early mortality, vegetative competition and browsing animals are considered detrimental (8).

Natural reproduction has been successful following both clear cutting and partial cutting. Either clear cutting in small units, not more than 10 chains across, or shelterwood cuttings that leave as

much Port-Orford-cedar as possible in the residual stand should prove suitable for natural reproduction (8).

Port-Orford-cedar survives well in plantations. Average survival in 26 plantations 8 to 26 years after establishment was 65 percent. Browsing animals and competition were considered the foremost causes of mortality.[7/] Ten of the plantations contained Douglas-fir, average survival of which was 61 percent. Of 50 newly planted trees that were staked in a plantation on the Siskiyou National Forest, only two had died after 2 years.

Early growth. --One-year-old seedlings averaged 1.4 inches tall and 2-year-old seedlings averaged 3.1 inches tall in deer exclosure plots on the Port-Orford-Cedar Experimental Forest. Planted trees (3-0 stock) averaged 18.8 inches in height 2 years after outplanting.

Sapling Stage to Maturity

Growth and yield. --Port-Orford-cedar is capable of moderately rapid growth, but it slows greatly if overtopped by other trees. The history of typical west coast mixed stands is interpreted as follows: Most natural stands originated after fire, and for a few years Port-Orford-cedar was able to maintain a position of dominancy. But after 20 or 25 years, Douglas-fir and some other species surpassed it, and it was left in the understory. Here, its growth was greatly retarded. Port-Orford-cedars containing one minimum-sized saw log 32 feet long with an 8-inch top diameter were approximately 200 years old in natural mixed stands in southwestern Oregon. Average d.b.h. of the species at various ages in typical stands is as follows:

Average age (years)	Number of trees	Average d.b.h.
100	8	10.7
173	5	19.6
251	11	30.7

7/ James, Geo. A. Port-Orford-cedar plantations in the Pacific Northwest. (In process of publication by U. S. Forest Serv. Pac. NW. Forest and Range Expt. Sta.)

Port-Orford-cedar in pure stands is capable of very substantial yields. In a study of 26 plantations along the west coast from Puget Sound to northern California, average height growth was 0.83 feet per year. The stands ranged from 8 to 26 years old. However, many of the plantings had been subjected to considerable browsing by deer and domestic animals and to varying degrees of competition from natural reproduction of other species. Average annual height growth was 1.15 feet on unbrowsed trees that had been subjected to only light or moderate competition.

Tree heights in the two best plantations averaged 32 feet and 40 feet at ages 14 and 19 years, respectively.[8/] In two relatively pure natural stands, the mean height of Port-Orford-cedar was 51 feet and 73 feet at ages of 36 years and 44 years.

Growth in plantations in western Europe compares favorably with growth of native pine and spruce there (1, 3, 4, and 10) and with growth of Port-Orford-cedar in natural stands in western Oregon (table 1).

Reaction to competition. --Port-Orford-cedar commonly maintains a position of dominancy in mixed stands up to 20 to 25 years of age, after which it is usually overtopped and grows slowly. But it is shade tolerant (2) and long lived, and retains to a very old age the capacity to respond to release. In natural mixed stands, the Douglas-firs and other overstory trees gradually die after 250 or 300 years, releasing the persistent Port-Orford-cedars. Beyond 400 years the overstory may be composed largely of cedars, with a cedar and hemlock understory. If stands were continuously protected from fire and cutting, the climax type would probably be Port-Orford-cedar and western hemlock (11).

Damaging agents. --Port-Orford-cedar is subject to windthrow, especially if loaded with snow. It has no taproot, and the numerous laterals are commonly of small diameter (1, 4). Europeans have also found that Port-Orford-cedar is damaged by hard frosts and drying winds (3) and is liable to become "top dry" if planted in places that are either too wet or too dry (10). It has a tendency to grow multiple stems at almost any height, both in Europe and in western Oregon.

The young trees are readily killed by fire; but the old, thick-barked trees are very resistant.

8/ See footnote 7, page 7.

Table 1.--Yield per acre, young stands of Port-Orford-cedar in western Oregon and western Europe

Location	Stand age	Total stand (all species)		Port-Orford-cedar only				
		Stems	Basal area	Stems	Basal area	Average diameter	Average height	Volume
	Years	Number	Sq.ft.	Number	Sq.ft.	Inches	Feet	Cu.ft.
Western Oregon (natural stands):								
Coos-Curry County Line	44	750	408	610	287	9.3	1/ 73	7,230
Coos-Curry County Line	43	690	348	560	222	8.5	1/ 72	6,360
Coos County Forest	36	1,360	298	820	179	6.3	1/ 51	3,490
Coos County Forest	40	1,140	312	550	157	7.2	1/ 52	2,930
Port Orford	61	680	490	590	393	11.1	1/ 74	11,980
Port Orford	57	670	548	600	503	12.4	1/ 73	13,800
Western Europe (planted stands):								
Vernand-dessons, Switzerland 2/	45	--	--	340	--	9.4	71	7,532
Belle-Etoile, Belgium	20	--	--	1,206	123	4.3	27	1,401
Belle-Etoile, Belgium	30	--	--	1,068	200	5.8	42	3,930
Holstenshuus Forest Dist., Denmark								
Living trees	28	--	--	861	146	5.6	42	3,902
Removed in recorded thinnings	--	--	--	671	63	--	--	1,195
Holstenshuus Forest Dist., Denmark								
Living trees	46	--	--	527	217	8.7	54	6,726
Removed in recorded thinnings	--	--	--	520	85	--	--	2,058

1/ Height of trees of mean basal area.

2/ Planted in mixture with beech and spruce. Some cutting mentioned. Included only about half the number of cedar stems desired for pure stands on good sites.

The only known serious enemy of Port-Orford-cedar is a killing root disease, Phytophthora lateralis, which recently invaded the natural range of the species (13). The potential destructiveness of this disease must yet be learned. A white pocket heart rot, caused by an unidentified fungus, is common in old-growth stands and causes moderate losses. None of the insects that attack the species have caused serious damage.

RACES

About 70 horticultural varieties are recognized (5). European foresters recognize individuals of different appearance that seem to differ also in adaptability to European conditions.

ECONOMIC STATUS

In the past, Port-Orford-cedar was highly prized for specialized products, especially battery separators, and the species commanded premium stumpage prices. In recent years, however, other materials and woods have largely replaced Port-Orford-cedar in these markets. As a result, it is now considered a species of secondary importance in forest management in its native range in Oregon. The many desirable qualities of the wood, however, adapt it to a wider variety of uses than the wood of other species in the area and make Port-Orford-cedar a desirable species for retention in stands where it occurs naturally.

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